

SCIENCE

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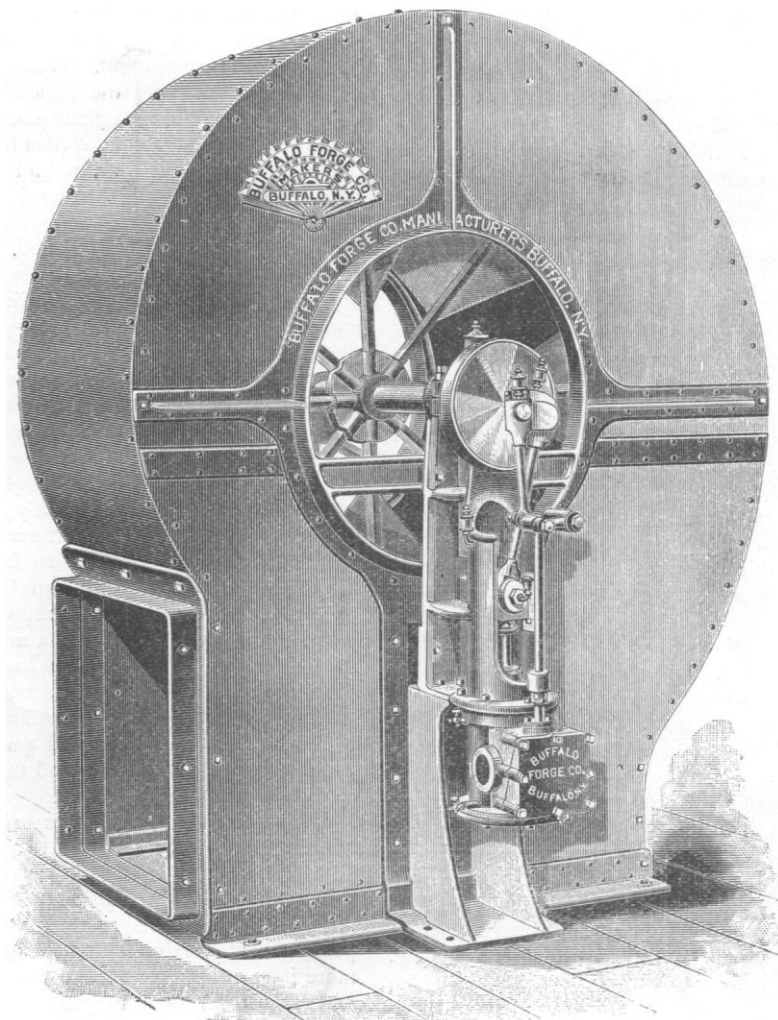
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AN IMPROVED STEAM-DRIVEN FAN.

THE accompanying illustration shows a new design of fan driven direct by a vertical steam engine, making a compact and direct-acting piece of machinery. There is no question but that the direct attached engine affords far superior advantages in fan propulsion, there being no slipping or wearing of belts, the rate of speed being easily increased or diminished as occasion requires, perfect control of the fan as to starting and stopping instantly be-

The engine shown is for either high or low pressure steam, and runs with very little friction, as it has balanced valves. It is made in sizes ranging from two to fifty horse-power where high-pressure steam is used.

By reference to the engraving, it will be noted that while doing its work, the engine acts as a brace to the blower, the base of which is made of the best angle steel. The amount of bearing surface also deserves comment, being one of the engine's strong points, considering its compact build. In a one-hundred-inch fan



STEAM-DRIVEN FAN.

ing secured. Where economy of space is an object this combination possesses great advantages, as but little more room than that taken up by the fan itself is required, which is less than that used with a pulley and belt. In some makes of fans with direct attached engines the engine has been attached so as to leave no space between it and the blower, but where perfectly noiseless action is imperative, some space should be left. And when the fan is required for continuous use, the latter is the more satisfactory plan.

the shaft is three inches and a quarter in diameter, and the bearings are fifteen inches and three-quarters long.

There can hardly be a doubt that the great variety of uses to which blowers may be readily adapted was never realized in the earlier periods of their manufacture; but when one reviews the substantial growth each year in this one branch of the manufacturing business alone, it is no marvel that neither pains nor expense are spared to produce patterns which in design, durability, and

construction are abreast of the times, and fully satisfy the rapidly increasing demand for them.

In order to be a complete success, a direct driven fan should possess high speed, ability to run continuously, and oft-times in the midst of considerable dust, without the engineer's attention at any regular time. These qualities seem to be fully secured in the fan shown, which is made by the Buffalo Forge Company of Buffalo, N.Y.

CLARK UNIVERSITY.¹

WE are here to mark in a simple way, as befits its dignity, a rare event, which we hope and pray may prove not only the most important in the history of this favored city, but of forever growing significance for our state and nation, for culture and humanity.

Located, with great forethought, in a city whose culture ensures that enlightened public sentiment so needful in maintaining the highest possible academic standards; in a city whose wealth and good will, we trust, are as fair a promise as can anywhere be given or asked of that perpetual increase of revenue now required by the rapid progress of science; in a city central among the best colleges of the East, whose work we wish not only to supplement but to stimulate, whose higher interests we hope to serve, and whose good will and active co-operation we invite; governed by trustees of eminence in the nation as well as in the state, who ask no sectarian and no political questions of their appointees, whose influence without and whose counsels within are of inestimable and well appreciated value; consecrating ourselves to the toil of science at an hour so peculiarly critical and so opportune in the university development of the country, — I must believe that not only every intelligent inhabitant of Worcester, but every unbiased friend of higher education everywhere, will wish to add to our already unexpectedly large endowment of public and private good will at home and abroad, his and her hearty, ungrudging, and reiterated God-speed.

Just because, instead of the easy and wasteful task of repeating what is already well done about us, we strive to take the inevitable next step, and to be the first, if we can, upon the higher plane; because we must study not only to utilize all available experience wherever we can, but to be wisely bold in innovations wherever we must; because there will be indifference and misconception from friends who do not see all the importance of our work at first; because there are difficulties inherent in the very nature of that work itself as great as the work is needed, — we must go slowly and surely, establishing but few departments at first, and when they are made the best possible, adding new and most related ones as fast as we can find the men and money to support them. We must prolong the formative period of foundation, and must each and every one realize well that we are just entering upon years of unrelenting toil, in which patience and hope will be tempered with trial. But our cause is itself an inspiration, for it is in the current of all good tendencies in higher education; and of the ultimate success of what is this day begun, there is not a shadow of doubt or of fear.

Our history begins more than twenty years ago, in the plans of a reticent and sagacious man, whose leave we cannot here await to speak of, who in affluence maintains the simple and regular mode of life inbred in the plain New England home of his boyhood, — plans that have steadily grown with his fortune, and that have been followed and encouraged with an eager and growing interest, which extended to even minor items, by the devoted companion of his life. Besides a large fund already placed to our account, he has given his experience and unremitting daily care, worth to us large sums in economies, and resulting in well-appointed buildings, and a solidity of materials and a thoroughness of workmanship which I believe are without a parallel of their cost and kind in the country. Not only in the multifarious work of the university office, its methods of estimates, orders, book-keeping, of individual accountability for all books, apparatus, supplies, and furniture, but in the larger questions of university polity without and effective administration within; in the definition of duty for each officer, the strict subordination and the concentration of authority and responsibility sure to

appeal to all who have the instinct of discipline, and which are exceptionally needful where the life of science is to be so free, and the policy so independent; in the express exemption, too, of all instructors who can sustain the ardor of research from excessive teaching and examination, in the appointment of assistants in a way to keep each member of the staff at his best work and to avoid the too common and wasteful practice in American universities of letting four-thousand-dollar men do four-hundred-dollar work, in the ample equipment of each department, that no force be lost on inferior tools, — in all these and many other respects, the ideal of our founder has been to make everywhere an independent application of the simplest and severest but also the largest principles of business economy.

As business absorbs more and more of the talent and energy of the world, its considerations more and more pervading if not subordinating, whether for better or worse, not only the arts, the school, the press, but all departments of church and state, making peace and war, cities or deserts, so science is slowly pervading and profoundly modifying literature, philosophy, education, religion, and every domain of culture. Both at their best have dangers, and are severe schools of integrity. The directness, simplicity, certainty, and absorption in work so characteristic of both, are setting new fashions in manners, and even in morals, and bringing man into closer contact with the world as it is. Both are binding the universe together into new unities and imposing a discipline ever severer for body and mind. When their work, purified of deceit and error, is finished, the period of history we now call modern will be rounded to completeness, culture will have abandoned much useless luggage, the chasm between instruction and education will be less disastrous, and all the highest and most sacred of human ideals will not be lost or dimmed, but will become nearer and more real.

When one who has graduated with highest honors from this rigorous school of business, after spending eight years of travel abroad studying the means by which knowledge and culture — the most precious riches of the race — are increased and transmitted, and finding no reason why our country, which so excels in business, should be content with the second best in science, devotes to its services not only his fortune at the end of his life, but also years yet full of exceptional and unabated energy, we see in such a fact not only the normal, complete, if you please, post-graduate ethical maturity of an individual business life, but also a type and promise of what wealth now seems likely to do for higher education in America. It is no marvel that our foundation has already been so often, so conspicuously, and so favorably noted in authoritative ways and places in an European land, where, if monarchy should yield to a republic, university culture could not penetrate its people as it now does. It is thus a more typical and vital product of the national life at its best than are foundations made by state or church in which to train their servants. In thus giving his fortune to a single highest end as sagaciously and actively as he has acquired it, may our founder find a new completeness of life in age, which Cicero did not know, and taste "all the joy that lies in a full self-sacrifice."

The very word "science," especially when used in its relation to business, is too often degraded by cheap graduates who are just fit to look after established industrial processes, but are useless if competition finds or needs new and better ones; who certify to analyses of commercial products that good chemists know are impossible; who, if international competition in manufactures were more free, would give place to better trained, perhaps German, experts still faster than they are doing; who in criminal, medical, and patent-law suits often have the address to carry judge and jury against far better chemists, but who have no conception of the higher quality and more rigorous methods of their own science; who make chemistry, physics, and geology mercenary, culinary, the servants instead of the masters of industrial progress and the very "life-springs of all the arts of peace or war." This evil, although so great and common that even the best men in other professions too rarely see the high ideal culture-power of real science, is yet only incidental and temporary.

A good illustration of the high and normal technological value of pure science is at hand in dyeing, one of the most scientific among

¹ Address delivered by President G. Stanley Hall at the opening of Clark University, Worcester, Mass., on Oct. 2, 1889.

the many and increasing chemical industries. England furnishes nearly all the raw, formerly valueless, material for coal-tar colors, out of which Germany made most of the seventeen and a half million dollars' worth manufactured in 1880. England bought back a large fraction of the colored goods, and Germany made the profits, because she could furnish the best training in pure chemistry. It is for this reason that she is driving other countries out of the field in other leading chemical industries. The great factories there employ from two or three to more than a score each of good, and often the best, university-trained chemists, at large salaries, and the best of these spend a good part of their time in original research in the factory laboratories. The prospect of these lucrative careers has had very much to do in filling the chemical laboratories of the universities with hundreds of students, and the German government (best that of Prussia) has met the demand by erecting and equipping new and sometimes magnificent laboratories at nearly all of her universities. New artificial processes of making organic products of commerce have freed thousands of acres of land where they were formerly grown, and have made new industries and often impaired old ones. Many professors of chemistry make large outside incomes. Nearly all are sanguine, some even declare, that before very long leading drugs, and even food, that will equal if not actually excel nature's products, will be made artificially. The leading professor in one of the largest chemical laboratories of Germany told me in substance that he no longer went after outside technical work, but now made it a virtue to wait for it to seek him; and it has been strongly urged that even the government should take steps to prevent the migration of German chemists to the universities of other countries, lest Germany lose her pre-eminence in chemical industries.

This remarkable contact of the marvellous new business-life and energy of Germany, particularly of North Germany (which in both suddenness and vigor equals any of the wonderful developments in this country), with staid and tranquil academic ways, has had some marked reverberations, and given new direction and impetus to other studies in some other departments where it is not directly felt. It has led to the erection and equipment by the government of great technological schools, and has shown to business men and employers that no course in the sciences which underlie technology can be too advanced, prolonged, or severe to be practical. Where ought the value and significance of such a training be better appreciated than here in the land of Fulton, Morse, Bell, and Edison?

There are, however, eminent chemists in Germany, and many more in surrounding European countries, who deplore what they call the irruption of the technical spirit into the universities. They fear the proximity of the factory and the patent office to the university laboratory has narrowed the field of view and made methods of research relatively less severe; they complain that in their teaching they must hasten over inorganic chemistry, neglecting all the other elements for the carbon compounds, and that there are almost no inorganic chemists in Germany; that in choosing between several substances inviting research, one of which promises great commercial value and the other none, strict scientific impartiality is lost; that in the eagerness for practical results, problems are attempted too complex for the present methods of experimenters, who are trying to "eat soup with a fork," as one sadly told me, and that thus, while published researches are more numerous they are less thorough, and have introduced many formulæ that neither prove nor agree, so that much work now accepted must be done over again and far more thoroughly; that even Liebig set a bad example in this respect, and that many new products, of which university chemists boast, are so inferior to those of nature as to be really adulteration.

What I have tried to illustrate mainly in the field of one science is more or less true under changed ways and degrees in the sphere of others. The sciences are also at the very heart of modern medical studies. Biology explores the laws of life, upon which not only these studies but human health, welfare, and modern conceptions of man and his place in nature, so fundamentally rest. The law of the specific energy of nerves, e.g., which Helmholtz says equals in importance the Newtonian law of gravity, and more than anything else made physiology the science which has had so large

a share in raising the medical profession in Germany to a position in the intellectual world such as it never had before, doing for it in some degree what chemistry has done for dyeing; and even instruments like the ophthalmoscope, which almost created a department of medical practice, or the spectroscope, now indispensable in the Bessemer process, in sugar refining, in wine and color-dye tests, the detection of photographic sensibilizers, in the custom-house, and in two important forms of medical diagnosis, — all these, to cut short a long list of both epoch-making laws and important instruments, are the direct products of whole-souled devotion to unremunerative scientific research.

It is hard for medical students to realize that they cannot understand hygiene, forensic medicine, pharmacology, and toxicology without a rigorous drill in chemistry; that they must know physics to understand the diagnostic and therapeutic use of electricity, ophthalmology, otology, the mechanism of the bones, muscles, circulation, etc.; that zoology is needed to teach sound philosophic thought, generic facts about the laws of life, health, reproduction, and disease. These, and sometimes also sciences like mineralogy, anthropology, and psychology, are required in Europe, with much more rigor than is common with us, of every medical student. Thus doctors, like technologists, cannot know too much pure science. An eminent medical practitioner in Europe compares young physicians who slight the basal sciences of their profession and pass on to the clinical, therapeutic, and practical parts, to young men who grow prematurely old and sterile. The phrase of Hippocrates, "God-like is the physician who is also a philosopher," is still more true and good in its larger, more modern, and looser translation, viz., exalted is the physician who knows not only the most approved methods of practice, but also the pure sciences which underlie and determine both the dignity and the value of his profession.

Medical instruction, on the one hand, must select as its foundation those sciences and those parts of the sciences most useful in meeting man's great enemy, disease. It needs far more anatomy than physics, and little mathematics, astronomy, or geology. Technical instruction, on the other hand, is and must be so organized as to reflect the state of industry. It properly lays more stress upon chemistry, with its many applications, than upon biology, which has far fewer; more upon electricity than upon molecular physics; and more upon organic than inorganic chemistry. The university, which is entirely distinct from and higher than any form of technical or professional instruction can be, should represent the state of science *per se*. It should be strong in those fields where science is highly developed, and should pay less attention to other departments of knowledge which have not reached the scientific stage. It should be financially and morally able to disregard practical application as well as numbers of students. It should be a laboratory of the highest possible human development in those lines where educational values are the criterion of what is taught or not taught, and the increase of knowledge and its diffusion among the few fit should be its ideal. As another puts it, "The more and better books, apparatus, collections, and teachers, and the fewer but more promising students, the better the work." In Europe, besides its duty to science, the university must not fail of its practical duty to furnish to the state good teachers, preachers, doctors, advocates, engineers, and technologists of various kinds. Here a university can, if it chooses, do still better, and devote itself exclusively to the pure sciences. These once understood, their applications are relatively easy and quickly learned. The university must thus stand above, subordinate, and fructify the practical spirit, or the latter will languish for want of science to apply.

The important facts that are both certain and exact, and the completely verified laws, or well ordered, welded cohesion of thought that approach such mental continuity as makes firm, compactly woven intellectual or cerebral tissue, are so precious in our distracted and unsettled age, that it is no marvel that impartial laymen in all walks of life are coming to regard modern science in its pure high form as not only the greatest achievement of the race thus far, but also as carrying in it the greatest though not yet well-developed culture power of the world, not only for knowledge but also for feeling and conduct. It is of this power that universities are the peculiar organs; to them is now committed the highest in-

terests of man; from them and from science now come the light and advancement of the world. They became and remained the asylums of free thought and conviction when Rome and all other privileged orders declined, and their germs were brought and piously and early planted on these shores by our fathers. The term is not only "the noblest in the vocabulary of science," but universities are the chief nurseries of talent, where is kept alive the holy fervor of investigation, that in its passion for truth is fearless of consequences, and has never been more truly and loftily ideal than now, when its objects of study are often most crassly material. It is their quality more than any thing else that determines not only the status of the medical and all technological professions, but also whether the legal profession is formal, narrow, mercenary, and unlearned, as it seems now in danger of becoming in Germany; because even the German universities, despite their great pre-eminence in all other respects, are by general consent of the most competent Germans themselves relatively weak in those departments which underlie the practice of law, or broadly based on history and social or economic science, informed in administrative experience, and culminating in judicial talent and statesmanship. Universities largely determine whether a land is cursed by a factious, superstitious, half-cultured clergy, or blessed by ministers of divine truth, who understand and believe the doctrines they teach; who attract and enlarge the most learned, and penetrate the life of the poor and ignorant, quickening, comforting, and informing in a way worthy the Great Teacher himself, and making their profession as it should be—the noblest of human callings.

Compared with our material progress, we are not only making no progress, but are falling behind in higher education. It has been estimated that but five per cent of the practising physicians of this country have had a liberal education, and that sixty per cent of our medical schools require practically no preliminary training whatever for admission, while European laws require a university training for every doctor before he can practice. Again, we apply science with great skill, but create or advance it very little indeed. Should the supply of European science, which now so promptly finds its way here and fertilizes and stimulates to more or less hopeful reaction our best scholars, and upon which we live as upon charity, be cut off by some great war or otherwise, the unbalanced and short-sighted utilitarian tendencies now too prevalent here would tend toward the same stagnation and routine which similar tendencies, unchecked, long ago wrought out in China. We all most heartily believe in and respect technical and applied science and all grades of industrial education, but these are as much out of place in a truly academic university as money-changers were in the temple of the Most High.

But yet the fact that these and other evils and difficulties are now so widely seen and so deeply felt, that endowments for higher education seem now the order of the day, that the largest single endowment in this country has already so effectively begun so many reforms in scarcely more than a decade in Baltimore; that churchmen, statesmen, and business men now need only to see their own interests in a way a little larger and broader, as they are now tending to do, to co-operate more actively than they ever have done in strengthening our best foundations, — such considerations sustain the larger and more hopeful view that our country is already beginning to rise above the respectable and complacent mediocrity still its curse in every domain of culture, and will show that democracy can produce — as it must or decline — the very highest type of men as its leaders. The university problem seems to be fairly upon us. We now need men in our chairs whose minds have got into independent motion, who are authorities and not echoes, who have the high moral qualities of plain and simple living and self-sacrificing devotion to truth, and who show to this community and the country the spectacle of men absorbed in and living only for pure science and high scholarship, and are not mere place-holders or sterile routine pedagogues, and all needed material support is sure to come.

A word so characteristic here that it might stand upon our very seal, is "concentration." Of this, our founder, in declining to scatter his resources among the countless calls from individuals, institutions, and causes, from excellent to vicious, and refusing us as yet, in the one work he has set out to accomplish, no needed

thing, sets an example. We have selected a small but closely related group of five departments, and shall at first focus all our means and care to make these five the best possible. Neither the historical origin nor the term "university" have any thing to do with completeness of the field of knowledge. The word originally designated simply a corporation with peculiar privileges, and peculiarly independent to do what it chose. We choose to assert the same privilege of election for ourselves that other institutions allow their students, and offer the latter in choosing their subjects a larger option between institutions. The continental habit of inter-university migration, also, on the part of students, if once adopted here, would no doubt stimulate institutions no less than it has stimulated competing departments in the same university. Our plan in this respect implies a specialization as imperatively needed for the advanced students as it would, we admit, be unfortunate for students still in the disciplinary collegiate stage. If our elementary schools are inferior to the best in Europe, and if our fitting schools are behind the French Lycee, the German gymnasium, and the great English schools, it is our universities that are comparatively by far the weakest part of our national system. The best of these best know that fifty or one hundred instructors cannot do the work of three hundred and fifty; that they cannot hope at present to rival European governments which erect single university buildings costing nearly four million dollars each, as at Berlin and Vienna, nor equal the clinical opportunities of large European cities with poorer populations and more concentrated hospital systems. Our strongest universities are far too feeble to do justice to all the departments, old and new, which they undertake. Our institutions are also too uniform; the small and weak ones try to copy every new departure of the stronger ones, as the latter copy the far stronger institutions in Europe. If the best of them would do work of real university grade, should they specialize among the fields of academic culture, doing well what they do, but not attempting to do every thing, the American system might yet come to represent the highest educational needs of the country. In contrast with the present ideal of horizontal expansion and the waste of unnecessary duplication, we believe our departure will be as useful as it is new.

Again, concentration is now the master word of education. In no country has the amount of individual information been so great, the range of intelligence so wide, the number of studies attempted by young men in colleges and universities so large for the time and labor given to each, the plea for liberal and general, as distinct from special and exclusive studies, been so strong. This is well, for general knowledge is the best soil for any kind of eminence or culture to spring from, and because power, though best applied on a small surface, is best developed over a large one, and not in brains educated, as it were, in spots. More than this, our utilitarian ideal of general knowledge is far more akin to that of Hippias, who would make his own clothes and shoes, cook his own food, etc., or to that of Diderot, who would learn all trades, than to the noble Greek ideal of the symmetrical all-sided development of all the powers of body and mind. The more general knowledge the better; but every thing must shoot together in the brain. In the figure of Ritcher, the sulphur, saltpetre, and charcoal must find each other, or the man makes no powder. The brain must be trained to bring all that is in it to a sharp focus without dispersive fringes. The natural instinct of every ambitious youth is to excel; to do, or make, or know something better than any one else, to be an authority; to surpass all others, if only in the most accumulated speciality. Learning thus what true mental freedom is, he is more docile in all other directions.

If it be extravagant to say that no minds are so feeble that they cannot excel, if they concentrate all their energies upon a point sufficiently small, nothing is more true than that the greatest powers fail if too much is attempted. This is not only a wise instinct that makes for economy, but, in the parliamentary committee-rooms, in corporation meetings, in the court room, in business, in science, in the sick-chamber, the modern world in nearly every department is now really governed by experts, — by men who have attained the mastery that comes by concentration. The young man who has had the invaluable training of abandoning himself to a long experimental research upon some very special but happily-

chosen point was typically illustrated in a man I knew. With the dignity and sense of finality of the American senior year quick within him, his first teacher in Germany told him to study experimentally one of the score of muscles of a frog's leg. He feared loss and limitation in trying to focus all his energies upon so small and insignificant an object. The mild dissipation of too general culture, the love of freedom and frequent change, aided by a taste for breezy philosophic romancing, almost diverted him from the frog's leg. But as he progressed he found that he must know in a more minute and practical way than before — in a way that made previous knowledge seem unreal — certain definite points in electricity, chemistry, mechanics, physiology, etc., and bring them to bear in fruitful relation to each other. As the experiments proceeded through the winter, the history of previous views upon the subject were studied and understood as never before, and broader biological relations gradually seen. The summer, and yet another year, were passed upon this tiny muscle, for he had seen that its laws and structure are fundamentally the same in frogs and men, that just such contractile tissue has done all the work man has accomplished in the world, that muscles are the only organ of the will. Thus, as the work went on, many of the mysteries of the universe seemed to centre in his theme; in fact, in the presence and study of this minute object of nature he had passed from the attitude of Peter Bell, of whom the poet says,

"A cowslip by the river's brim
A yellow cowslip was to him,
And it was nothing more,"

up to the standpoint of the seer who "plucked a flower from the crannied wall," and realized that could he but understand what it was, "root and all, and all in all, he would know what God and man is." Even if my friend had contributed nothing in the shape of discovery to the great temple of science, he had felt the *omne tulit punctum* of nature's organic unity, he had felt the profound and religious conviction that the world is lawful to the core; he had experienced what a truly liberal education, in the modern as distinct from the mediæval sense, really is. We may term it non-professional specialization.

Perhaps the most thorough and comprehensive government reports ever made in any language are those of the English parliamentary commissioners on endowments. The first of these occupied nearly nineteen years, and fills nearly two-score heavy folio volumes. In all, about twenty thousand foundations, new and centuries old, large and small, devoted to a vast variety of uses, good and questionable, were reported. The conclusions drawn from this field of experience, which is far richer and wider in England than elsewhere, was, that, of all the great popular charities, higher education has proven safest, wisest, and best, and that for two chief reasons: first, because the superior integrity and ability of the guardians who consented to administer such funds, the intelligence and grateful appreciation of those aided by them, and the strong public interest and resulting publicity, all three combined to hold them perpetually truest to the purpose and spirit of the founders; and secondly, because in improving higher education, all other good causes are most effectively aided. The church can in no other way be more fundamentally served than by providing a still better training for her ministers and missionaries. Charity for hospitals and almshouses is holy, Christ-like work, but to provide a better training for physicians and economists, teaches the world to see and shun the causes of sickness and poverty. Sympathy must always tenderly help the feeblest and even the defective classes, but to help the strongest in the struggle for existence, is to help not them alone, but all others within their influence.

Of all the many ways of supporting the higher education, individual aid to deserving and meritorious students is one of the most approved. In the University of Leipzig, e.g., four hundred and seven distinct funds can aid eight hundred and forty-nine students. Of these funds, the oldest was established in 1325, and they are increasing in number, more new ones having been given between 1880 and 1885 than in any entire decade before. In size they range from thirty-five thousand to fifty dollars; in Berlin, from one hundred and forty thousand to one of less than forty dollars. In cases where conditions are specified, the most frequent limitation is to students from a certain locality, and next, to those of a certain

family. By the older founders students of theology were more often preferred, but the more recent funds are for medicine, law, philology, and pure science; and a fund of over two hundred thousand lately given the University of Marburg is for advanced students in those sciences which underlie medicine. These funds are often given, named for, held, and sometimes awarded by churches or their pastors, magistrates, heads of fitting schools, boards of education, representatives of prominent families, for students of their name, the donor himself or herself, individual professors, etc., subject of course to satisfying the university examiners. Many are tenable for one, more for three, and some for five and six years. The funds must be invested with pupillary security, and with interest commonly less than four per cent. In Cambridge and Oxford provision is made for nearly one thousand fellows and eight hundred scholars, not to mention the exhibitions at Oxford. The fellowships are more lucrative, and are designed for more advanced men than are provided for in the German universities, the fellows aiding the master in internal administration. In England, besides the religious and other founders, as in Germany, the great historic industrial and mercantile corporations provide many of the fellowships and scholarships, particularly those of the sixteenth and seventeenth centuries; and they are granted by bishops, curates, heads of business corporations, masters of the great schools, heads or fellows of colleges. In France, where these foundations were swept away by the Revolution, stipends and bursaries are provided annually by the government. New appropriations for the most advanced students of all was the secret of the remarkable *Ecole Pratique des Hautes Etudes*, founded in 1868, of which a recent report just printed for the Exposition says, condensing its substance, that its purpose has always been to foster scientific zeal with no shade of temporal interest, that it restored the almost obliterated idea of higher education, gave unity to scientific interests throughout France, and made her feel the scholarly desiderata of the age; made young professors not only well instructed, but trained in good methods; that, although its profound researches are not manifest to the public, it has given a more scientific character to all the faculties, and rendered a service to the state out of all proportion to its cost. In France individuals co-operate with the state in this work.

Has there ever been devised a form of memorial to, and bearing the names of, husbands, wives, children, or parents, by which even the smallest funds could be bestowed in a way more lastingly expressive of the individuality, spirit, and the special lines of interest of the donor, more worthy the dead and more helpful to the highest ends of life? Since the first endowment of research in the Athenian porch and grove, thousands and thousands of donations of this sort have borne tangible witness to the sentiment so often and vividly taught by Plato, that, in all the world, there is no object more worthy of reverence, love, and service than eugenic, eupaptic, well-bred, gifted young men, for in them is the hope of the world.

The more advanced our standards are to be, the fewer will be our students, and the more expensive their needed outfit of books and apparatus. If we divide our running expenses only by the number of students our present fellowships and scholarships allow us to receive out of our two hundred and fifty applicants, the amount we spent per student, the first year, will probably be without a parallel. Besides this, for a number of students with important researches on hand, we are expending hundreds of dollars each for their individual needs, and should be glad to do so for more as good men. The best students very often graduate with empty pockets, but with their zeal and power at its best, and when an extra year or two would make a great difference in their entire career. Also, as the field of knowledge grows more complex, the economy of energy needed for concentration is impossible without the leisure secured by comfortable support.

Connected with all the protection, exemptions, and privileges so dearly prized and tenaciously clung to by the mediæval universities, there have always been dangers, sometimes grave and not yet entirely obviated. The new charity is often popularly called a science as well as a virtue. Its axiom is that no man has a right to give doles to beggars without satisfying himself personally or through some agency to that end that his gift will do good and not

harm to the recipient. History, and I may add personal observation, shows that the same general law holds true to some extent in universities. I believe they should not award fellowships to men fresh from college (save in the very rarest cases), unless they were able to guide and direct as well as to follow their work in every detail. A fellow should be encouraged and stimulated by a daily and familiar intercourse with the professors. His methods, reading, and researches should be kept at their best, and the entire resources of the institution should be a soil for his most rapid and helpful growth. Students thus served, even if their gratitude does not prompt them, as in some late instances in Germany, to study, revive and try to conform with piety to the ideal of ancient and almost forgotten donors, whose provisions they enjoyed, will not be lacking in appreciation. To appoint a man to use such funds in electing among undergraduate courses, or to take his chances among the confusing multifarious subjects offered in foreign institutions is, I believe, in most cases of small utility, and in some cases that I know, positively harmful. May the methods of exclusion we are studying be so effective that neither our precious funds nor the precious energy of our instructors be wasted upon the idle, stupid, or unworthy students, now too often exposed in vain for four years to the contagion of knowledge.

"Education used to be a question for ladies and for schoolmasters," said a French statesman last spring, but it is now not only a question of state, on which the support of all great institutions depends, but the great question into which all others issue if profoundly discussed or studied. So greatly do republics need the whole power of education, and so serious is their struggle for existence against ignorance and its attendant evils, that it has well been said that the problem whether this form of government be permanent is at bottom a question of education. But monarchies are no less dependent upon the education of their leaders and servants. In his famous address declaring that if Germany was ever to be free and strong, it must be by becoming the chief educational state of Europe, must realize the platonic republic in which the education of its youth was the highest care of the rulers, Fichte laid down the policy which has been one of the chief causes of the wonderful development of that country. Moreover, evolution, which shows that even life itself is but the education of protoplasm, cells, and tissues, that the play-instinct in children and the love of culture in adults not only measure the superfluous individual energy over and above that required by the processes necessary to life, but are perhaps largely the same, also makes it plain that the hunger for more and larger education of life is but the struggle of talent to the full maturity and leadership which is its right.

For myself, I have no stronger wish or resolve than that, in the peculiarly arduous labors I expect, I may never forget that this institution should be a means to these high purposes, and not degenerate to an end in itself: and may it be as true of our graduates to remotest time, as it is of us in a unique way and degree to-day, that we could not love Clark University so much, loved we not science and education more.

HEALTH MATTERS.

The Influenza.

A SINGULAR characteristic of the present epidemic of influenza is its delay in visiting the British Isles. It seems to have been rampant in Paris and in Germany for some time before it crossed the channel, and victims are claimed for Boston even before the existence of the disease in England was acknowledged. This naturally raises the question whether it is a disease really brought from a distance. Is it anything more than the general prevalence of catarrhal affections, of colds and coughs, which the time of year, and the remarkably unsettled weather we have lately experienced, make readily explicable without any foreign importation? Indeed, is influenza, after all, anything more than a severe form of the fashionable complaint of the season?

To answer the last question first, and so to put it by, there can be little doubt that influenza is a distinct, specific affection, and not a mere modification of the common cold.

The symptoms, the history of the disease, and its distribution, all justify us in treating it as a distinct and specific disease, which when it is prevalent will rarely be mistaken, though, with regard to isolated and sporadic cases, difficulties of diagnosis may arise. About its nature, or its affinities with other diseases, it is unnecessary to speculate. It will be sufficient to inquire what its recorded history in the past justifies us in expecting as to its behavior in the future. There are few cases in which history proves so important an element in the scientific conception of a disease as it does in that of influenza. For hardly any disease shows a more marked tendency to occur in epidemics — that is, in outbreaks strictly limited in point of time. After long intervals of inaction or apparent death, it springs up again. Its chronology is very remarkable. Though probably occurring in Europe from very early times, it first emerged as a definitely known historical epidemic in the year 1510. Since then, more than 100 general European epidemics have been recorded, besides nearly as many more limited to certain localities. Many of them have in their origin and progress exhibited the type to which that of the present year seems to conform. We need not go further back than the great epidemic of 1782, first traceable in Russia, though there believed to have been derived from Asia. In St. Petersburg, on January 2, coincidentally with a remarkable rise of temperature from 35° F. below freezing to 5° above, 40,000 persons are said to have been simultaneously taken ill. Thence the disease spread over the Continent, where one-half of the inhabitants were supposed to have been affected, and reached England in May. It was a remarkable feature in this epidemic that two fleets which left Portsmouth about the same time were attacked by influenza at sea about the same day, though they had no communication with each other or with the shore.

There were many epidemics in the first half of this century; and the most important of them showed a similar course and geographical distribution. In 1830 started a formidable epidemic, the origin of which is referred to China, but which at all events by the end of the year had invaded Russia, and broke out in Petersburg in January, 1831. Germany and France were overrun in the spring, and by June it had reached England. Again, two years later, in January, 1833, there was an outbreak in Russia, which spread to Germany and France successively, and on April 3, the first cases of influenza were seen in that metropolis: "all London," in Watson's words, "being smitten with it on that and the following day." On this same fateful day Watson records that a ship approaching the Devonshire coast was suddenly smitten with influenza, and within half an hour forty men were ill. In 1836 another epidemic appeared in Russia; and in January, 1837, Berlin and London were almost simultaneously attacked. Ten years later, in 1847, the last great epidemic raged.

Many interesting points are suggested by this historical retrospect. What is the meaning of the westward spread of influenza, of cholera, and other diseases? Is it a universal law? To this it must be said that it is by no means the universal law, even with influenza, which has spread through other parts of the world in every kind of direction, but it does seem to hold good for Europe, at least in the northern parts. The significance of this law, as of the intermittent appearance of influenza, probably is that this is in Europe not an indigenous disease, but one imported from Asia. Possibly we may some day track it to its original home in the East, as the old plague and the modern cholera have been traced.

As regards, however, the European distribution of influenza, it has often been thought to depend upon the prevalence of easterly and north-easterly winds. There are many reasons for thinking that the contagium of this disease is borne through the air by winds rather than by human intercourse. One reason for thinking so is that it does not appear to travel along the lines of human communications, and, as is seen in the infection of ships at sea, is capable of making considerable leaps. The mode of transmission, too, would explain the remarkable facts noticed above of the sudden outbreak of the disease in certain places, and its attacking so many people simultaneously, which could hardly be the case if the infection had to be transmitted from one person to another.

Another important question, and one certain to be often asked, is suggested by the last; namely, whether influenza is contagious. During former epidemics great care was taken to collect the ex-

perience of the profession on this point, and its difficulty is shown by the fact that opinions were much divided.

The constancy of type of influenza, the mode of its transmission, its independence of climatic and seasonal conditions, all suggest that its cause is "specific,"—that is, having the properties of growth and multiplication which belong to a living thing.

Whether the disease affects the lower animals is not absolutely certain, but the human epidemic has often been preceded or accompanied by an epidemic among horses of a very similar disease. It is pretty well known that such a disease is now prevalent among horses in London.

It is important that there should be observed and recorded during the present outbreak, as carefully as the great demands at such a period upon the time and strength of practitioners will permit, the cases they are called to. There are some especial points upon which more light is needed. Any observations which bear upon the accompanying insomnia, or upon the question of contagiousness should be noted with precision. The questions of relapse, of recurrence, of remission, of second attacks after complete recovery from a first attack, should all receive further elucidation from the present outbreak. The duration of the epidemic in different localities, its behavior with reference to climatic changes, the direction and force of the winds, etc., merit close attention. It can scarcely be doubted that the poison is a microphyte multiplying in the air, and yet there is reason to believe that it sometimes travels, and that not slowly, against the course of the winds. It will be interesting to learn whether the "influence" was encountered by our European "squadron of evolution" in its voyage across the Atlantic. We have heard that a month ago cases occurred on a steamer crossing the Pacific Ocean from Japan to San Francisco.

There has been a somewhat greater variation in the symptoms in different cases than is ordinarily encountered in most acute diseases dependent upon recognized specific poisons, although very possibly it may prove that these may be classified under two heads. It is desirable to note how far the present cases of influenza resemble and wherein they differ from dengue.

It must, of course, be borne in mind that the mild, moist, open, variable season which has thus far prevailed, predisposes to catarrhal troubles; and again that a prostrating affection like this "influenza" brings as an accompaniment or sequel to the weak, bronchitis and pneumonia. It is, on the other hand, remarkable that in not a few of the severest cases of "influenza" lately encountered, catarrhal affections of the mucous membranes have been very slight.

NOTES AND NEWS.

DURING the past summer, at the Agricultural Experiment Station of Cornell University, investigations have been made on the general subject of the deterioration of farm-yard manure, in three main directions; namely, (1) What loss does horse-manure suffer when thrown out in a pile unsheltered from the weather? (2) What loss does mixed farm-yard manure suffer when piled in a close pile so that fermentation is very slow; but without protection from rainfall? (3) Is there an appreciable loss of valuable matter when manure simply dries without fermentation? The results of one season's trial seemed to show that horse-manure thrown in a loose pile and subjected to the action of the elements will lose nearly one-half of its valuable fertilizing constituents in the course of six months; that mixed horse and cow manure in a compact mass, and so placed that all water falling upon it quickly runs through and off, is subjected to a considerable, though not so great a loss, and that no appreciable loss takes place when manure simply dries. Professor Shelton, from the results of somewhat similar experiments carried on at the Kansas Agricultural Experiment Station, concludes as follows: "The moral which the experiment plainly emphasizes is, that, farm-yard manures must be hauled to the field in the spring; otherwise the loss of manure is sure to be very great, the waste in the course of six months amounting to fully one-half the gross manure and nearly forty per cent of the nitrogen that it contained." To show that a large number of the farmers in the State are uninformed in this matter, or at least not sufficiently alive to its importance to take proper care of their manure, Mr. I. P. Roberts and Mr. Henry H. Wing,

who had charge of the investigation, have had engravings made of photographs of two actual "farm steadings" as they were found to exist, early last spring. These show particularly the watery, miry condition of the yards and the heaps of manure under the eaves. These are not isolated cases, but are fairly representative of a large number of similar views that were taken in one day in the course of a not very extended walk in a single locality, and that a dairy district. From what they have seen from car windows in their journeys through the State, much the same condition of things prevails generally.

— In a recent paper on zoogeography, in *Humboldt*, as condensed in *Nature*, Dr. Lampert states that a good many wolves are still captured in the east and west provinces of Germany, e.g., about fifty annually in Lorraine. In France, 701 wolves were destroyed in 1887; in Norway, only 15. It is estimated that in Russia the yearly loss in domestic animals through wolves is over ten million dollars, and the loss of game from the same cause, over thirty-five million. The German mole swarms apparently, in the neighborhood of Aschersleben, where 97,519 individuals were taken last year, and rewards amounting to nearly five hundred dollars were paid. In great part of Germany, however (Upper and Lower Bavaria, East and West Prussia), it is not met with. Mecklenberg and Pomerania are its northern limits at present. The beaver is nearly extinct in Germany, but a new settlement of thirty individuals was recently discovered at Regenwehrsberg, not far from Shönebeck, on the Elbe. A recent catalogue of diurnal birds of prey in Switzerland (by Drs. Studer and Fatio) gives thirty-two species. The disappearance of the golden vulture is here noteworthy. Early in this century it was met with in all parts of the Alpine chain; whereas now, only a very few individuals survive on the inaccessible heights of the Central Alps.

— An interesting inquiry into prehistoric textiles has been recently made by Herr Buschan. As stated in *Nature*, he examined tissues with regard to the raw material used, to their distribution in prehistoric Germany, to their mode of production, and to their alteration by lying in the ground. With certain chemical re-agents he was able to distinguish the various fibres, though much altered. The oldest tissues of Germany (as we now know it) come from the peat-finds of the northern bronze period. On the other hand, some articles of bone found in caves of Bavarian Franks, and evidently instruments for weaving or netting (bodkins, knitting needles, etc.), show that already in the Neolithic period textiles were made. The art of felting probably preceded that of weaving. Herr Buschan sums up his results as follows: (1) in the prehistoric times of Germany, wool (mostly sheep's) and flax were made into webs, but no hemp; (2) the use of wool preceded that of flax; (3) the wool used was always dark; (4) most of the stuffs were of the nature of huckaback (not smooth); (5) the textiles have, on the whole, changed but little in course of time. The author has some interesting observations on the oldest kinds of loom. The pile-builders on the Pfaffiker, Niederwyl, and Boden Lakes were busy weavers; and they knew how to work flax fibres not only into coarse lace, fish-nets, or mats, but into such finer article as fringes, coverlets, embroidery, and hair-nets.

— A point of great importance for the progress of Western science in the Chinese Empire is whether it should be taught in the Chinese or in a foreign language. The subject has been frequently discussed, and quite recently the opinions of a large number of men most prominently engaged in the education of Chinese were collected and published in a Shanghai magazine, the *Chinese Recorder*. The editor says that nine-tenths of these authorities are of opinion that the Chinese language is sufficient for all purposes in teaching Western science. One gentleman states that Chinese students can only be taught science in their own language, and that the long time necessary for them to acquire English for this purpose is wasted; another says that "science must be planted in the Chinese language in order to its permanent growth and development;" a third sees no reason why the vernacular should not be enough to allow the Chinese student to attain the very highest proficiency in Western science, although he admits that there is at present a want of teachers and text-books. Professor Oliver of the Imperial University at Peking says he has never found English

necessary, but has always taught in Chinese. Professor Russell of the same institution finds Chinese sufficient for popular astronomy. On the other hand, Mr. Tenney says that it can only be for the most popular views of science that the vernacular is sufficient. "It is impossible," he says, "for scholars who are ignorant of any European language to attain any such excellence in modern sciences as to enable them to bear comparison with the finished mathematical and scientific scholars of Europe and America." Thus, he continues, as a medium of thought, any Western language is incomparably superior to Chinese in precision and clearness; the student acquainted with a foreign language has a vast field of collateral thought open to him which does not and never will exist in Chinese, and he can keep abreast of the times, which the Chinese student who must depend on translations cannot do. The relation of the Chinese student "to the world of thought is analogous to that of a blind and deaf person in the West, whose only sources of knowledge are the few and slowly increasing volumes of raised-type letters which make up the libraries of the blind." As has been said, however, the weight of opinion is against Mr. Tenney.

— The special board of engineers appointed by the Secretary of War to examine and report upon the most available point on the Gulf coast west of the Mississippi for a deep-water harbor have selected Galveston. Their report is now before Congress. The expense of improving Galveston harbor so as to fulfil the requirements is estimated at \$6,200,000.

— It is generally recommended that cows at pasture in the summer should have a supplementary grain ration, and a large number of the more progressive farmers pursue this practice with an evident belief that it is profitable. In the absence of data as to the value of this practice it was deemed worth while to conduct, as carefully as might be, a somewhat extended experiment intended to afford, if possible, some light on the point in question. To this end a trial was instituted at the Cornell Agricultural Station, and conducted by I. P. Roberts and H. H. Wing. The experiment was made with six cows, selected from the University herd, making two lots mated in pairs, as nearly alike as was possible in age, breeding, time since calving, yield of milk, and time to next calving. The conclusion reached as the result of the experiment is, that, while all the data so far go to show that it did not pay to give cows on good pasture a supplementary grain ration, yet there is not as yet sufficient data to warrant recommending those who follow this practice to give it up. So far as results in butter are concerned, they are so close as to be almost identical. It is quite possible that the milk yield may have been more influenced by the "milking habit" of the cows than by the grain fed. By milking habit is meant the tendency that different cows have to milk for a longer or shorter period after calving. All the cows used in the experiment had been in milk for a considerable period, four of them about five months, and the other two considerably longer. It is not only possible but quite probable that these last two were more influenced by the individual tendency to "run dry" than by the extra grain feed in the ration. Several conditions arose during the course of the experiment that may or may not have influenced the results; and while in a certain sense they might be considered as foreign to the real discussion of the result, it seems worth while to mention them in this connection. (1) The rain-fall at Ithaca in the growing season of 1889 was phenomenal, especially in the months of June and July, the amounts in inches being as follows: June, 6.74; July, 6.73; August, 3.32; September, 2.57, while the average for the past 11 years has been June, 3.52; July, 3.95; August, 3.02; September, 2.44, and during the time of the experiment, June 8 to September 21, rain fell on forty-nine days. The pastures remained green, fresh, and luxuriant throughout the whole season. The grass, almost entirely blue-grass, grew continuously; but, owing to the gravelly character of the soil, the grass did not become soft and watery, as often happens in soils that are naturally more moist. Perhaps had there been the usual midsummer drought with its accompaniment of parched pastures, the results from the supplementary grain ration would have been more marked. (2) A striking feature of the experiment was the large increase in the percentage of fat in the milk of lot 2 during the period from Aug. 4 to Sept. 7 inclusive, and a similar slight in-

crease in the milk of lot 1 for the same period. This period coincided almost exactly with the period of least rainfall and highest temperature of the whole summer. From Aug. 5 to Sept. 5 inclusive, there was but one rain of any considerable amount, with some half dozen light showers on various intervening dates. Thus in the only time during the whole course of the experiment in which the conditions approached those of an ordinary season, there seemed to be the greatest effect from the grain ration. (3) Another peculiarity that seems to be traced to climatic conditions was seen in the last two weeks of the experiment. Beginning on Sept. 6, more or less rain fell on every day but one till the close of the experiment on the 21st. During this period the weather was almost continually cloudy and what may be expressively termed "raw." From Sept. 7 to 21, the percentage of fat in the milk of lot 1 fell from 4.47 to 4.10, or nine per cent, while the fat in the milk of lot 2 in the same period, decreased from 5.77 to 4.61, or twenty per cent. (4) In view of the fact that a citizen of a neighboring State has been imprisoned for selling milk that was below the legal standard of twelve per cent of solids, it seems worth while to state that while, when the average analysis for three days is taken into account, the milk in this experiment was far above the required standard, yet there was one day when the milk from one lot fell below the legal requirement of 12 per cent total solids, and several others on which the percentage of total solids came dangerously near the "dead line." Had a sample been taken on that day by the State authorities the experimenters would have been liable to conviction under the law, and to a fine of not more than two hundred dollars and to imprisonment for not more than six months. It seems that no law can be just that fixes an arbitrary standard for the purity of milk which may depend upon the results of a single analysis.

— Cocoa-nut butter is now being made at Mannheim, and, according to the American Consul there, the demand for it is steadily increasing. The method of manufacture was discovered by Dr. Schlunk, a practical chemist at Ludwigshafen. Liebig and Fresenius knew the value of cocoa-nut oil or fat, but did not succeed in producing it as a substitute for butter. The new butter is of a clear whitish color, melts at from 26° to 28° C., and contains 0.0008 per cent water, 0.006 per cent mineral stuffs, and 99.9932 per cent fat. At present it is chiefly used in hospitals and other State institutions, but it is also rapidly finding its way into houses or homes where people are too poor to buy butter. The working classes are taking to it instead of the oleomargarines, against which so much has been said during the last two or three years.

— In a recent number of *Humboldt*, as quoted in *Nature*, Herr Fischer-Sigwart describes the ways of a snake, *Tropidonotus tessellatus*, which he kept in his terrarium in Zurich. It was fond of basking in the sun on the top of a laurel, from which it climbed easily to a high cherry-tree fixed against a wall, its night quarters. Sometimes, after lying still for hours, it would hasten down into a small pond (about four square yards surface) containing gold-fish, and hide itself for a long time, quite under water, behind some stone, or plants, the tongue constantly playing. When a fish came near, the snake would make a dart at its belly. Often missing, it would lose patience, and swim after the fishes, driving them into some corner, where it at length seized one in the middle of the belly, and carried it to land, much as a dog would a piece of wood. Curiously, the fish, after being seized, became quite still and stiff, as if dead. If one then liberated it, the skin of the belly was seen to be quite uninjured, and the fish readily swam away in the water. The author thinks the snake has a hypnotic influence on its prey (and he had observed similar effects with a ringed snake). It would otherwise be very difficult for the snake to retain hold of a wriggling fish. The snake usually carried off the fish some distance to a safe corner, to devour it in peace.

— The International Marine Conference at Washington concluded its labors with the end of the year. The work it has done, though not so much as had been anticipated, will be of value to the merchant marine of all maritime nations. The chief work of the conference related to the rules of the road at sea and the prevention of collisions. One important reform recommended is uniformity in the buoyage system in all parts of the world, and others

relate to uniformity in surveying laws; in the reporting, marking, and removing of dangerous wrecks, derelicts, and other obstructions to navigation; and in the transmission of weather signals and storm warnings. This, we trust, is only the first of a series of similar conferences.

— The November meeting of the Chicago Institute of Education was quite a lively affair in comparison with the usual solemnity of the occasion, as we learn from *Intelligence*. The paper was by Fernando Sanford of the Englewood High School on the "Disciplinary Value of Scientific Study." It was a well-knitted plea for the genuine study of science, and for the formation of the habits of seeing and stating propositions that the actual study of nature produces. It deprecated the usual text-book study of science as unworthy of a place in any respectable school. The paper laid considerable stress on the idea that every pupil should interrogate nature for himself and find his own answers; that every subject should be taught by investigating it as if nothing had before been known about it. The president, Mr. Howland, wanted to put in a few words which he thought it possible the audience would not wish to remember more than three minutes, and he hoped they would not. Nevertheless, he wanted to say, that, while it was a charming paper, possibly the best one on the subject he ever heard or read, he did not believe in its doctrine at all. He did not believe that it is so necessary or so advantageous for children to handle the actual objects, to make so many experiments, to verify so many statements. The proposition that school children should investigate departments of science as if nothing had previously been known about them, and that the science learned from text-books is worthless, struck him as absurd. The other day he visited a school in which the pupils were studying a squirrel. He listened to their discovery of the number of toes it had, the way its joints bent, etc., etc. After all, what good did it do them? What did they learn about the squirrel that they did not know before? If children had got to study science just as if the world had already learned nothing, where is the blessing of living in this nineteenth century? of inheriting the accumulated intelligence of the ages? He didn't believe we should throw away all that past generations have discovered; in other words, all our books, and start our pupils in the study of nature where the human race began. He believed he had as clear and complete an idea of a camel before he ever saw one as he had afterwards. Talk about pupils proving that a floating body will displace its own weight of the fluid! What for? He never proved it or saw it proved. Yet he knew it, knew it as absolutely as if he had performed the experiment a hundred times. He didn't believe there ever was a time when he didn't know it. And so of the great mass of facts and principles which the paper would require to be taught inductively. Life is too short for us to indulge so freely in the time-wasting process of induction. He didn't believe in it. Let the pupil have the full benefit of his inheritance, and start with the present instead of with the beginning of time. And besides, man himself is the important element in this world. He and his institutions are more worth studying than all the rest beside. He would much rather study man than the rocks or the trees. It would be a misfortune if the advice of the paper were followed in our schools.

— The endeavor to establish a botanic garden in the City of Montreal, three years ago, though it met with great opposition at the time, says *Garden and Forest*, is likely to be realized at no distant day, though the original plan has been greatly modified. For some time past efforts have been directed toward the establishment of a garden in connection with McGill University, and the end has been so far attained that a portion of the grounds, embracing somewhat more than three acres, has been set apart for that purpose, the intention being to occupy eventually about six acres. During the past season a pond for aquatic plants has been constructed, and walks and beds have so far been laid out that planting will begin with the opening of spring. There are already in the grounds upward of one hundred native and exotic trees and shrubs, besides a fair collection of herbaceous plants. These will be added to from the native flora. There are also on hand several hundred specimens raised from seed received from the Imperial Botanic Gardens of St. Petersburg, and the Royal Gardens, Kew,

all of which have been raised and cared for in private grounds and conservatories. Active efforts are being made for the construction of a conservatory, which it is hoped may be erected soon. It is the intention to adapt the garden to the purposes of collegiate work and the representation of the native flora, together with such exotic species as may be hardy and prove otherwise desirable.

— According to the San Francisco *Examiner*, Mr. Adolph Sutro is experimenting with cinchona-trees on his estate on the neighboring sea-coast. He hopes to acclimatize at least some of the varieties from which quinine is produced; and, if so, will doubtless be more than repaid for his enterprise.

— The "flower festivals" of the Japanese are often referred to without clear explanation of their number and character. As explained in *Garden and Forest*, five are annually celebrated. At the New Year's feast, on the first day of the first month, the chief plants used are bamboos, firs, *Prunus Mume* and *Adonis Amurensis*. The first two are set by the house-door, and the others are displayed in the living-room. At the second, or "girls' festival," which is held on the third day of the third month, *Prunus Persica* is the favorite plant. At the third, or "boys' festival," on the fifth day of the fifth month, one sees chiefly the shobu (*Iris lavigata*); while at the fourth, or "ladies' festival," on the seventh day of the seventh month, no flowers are favored, but songs are written on bits of paper fastened to leafy stalks of bamboo and set on high in the garden. The last feast occurs on the ninth day of the ninth month, and then the chrysanthemum is honored by old and young alike. These various celebrations have always been held in accordance with the dates of the old national calendar; but now that the Gregorian calendar has been introduced, it is found difficult to procure the proper plants on the proper day. The great imperial feast in honor of the chrysanthemum has no special time set for it, but is held whenever the flowers in the Emperor's garden are in most perfect condition.

— Those who have read of the Rauhe Haus at Horn, near Hamburg, Germany, that remarkable and unique institution of Immanuel Wichern, will recognize in it a prototype of that little industrial community which more than two years ago was established in Columbia County, New York, under the name, "The Burnham Industrial Farm." The two are alike in purpose, in spirit, and in the methods of training employed. Wichern's experiment is, however, widely known, and its success has been demonstrated in its beneficent results, while Burnham Farm is yet in its infancy, unknown even to many of the good people of our own State. The Burnham Industrial Farm, as described in *The State Charities Record*, was organized to save boys who are tending toward the criminal classes. The lack of proper classification or facilities therefor in the reformatory institutions of the State, forcing the boys committed who have not yet become depraved or incorrigible into the companionship of those in whom criminal habits are fully developed, was the condition which was strongest in urging the establishment of a home like this, far removed from the city, on a large farm in healthful surroundings, where these truant and vagrant boys not yet incorrigible might be sent, might live under good moral influences and have opportunity for the training of hand and mind. The farm, formerly an old Shaker settlement, comprises 580 acres of land, under a fairly good state of cultivation, in a "region of pure air and lovely fields and forests." Lake Queechy bounds it on one side and the mountains look down upon it. The farm is organized on the family plan. The cottages left by the Shakers have become the home each of a group of boys. The system of awards and punishments is that of Mettray. There is a department of manual training for the boys where those showing special aptness are taught full trades, and others prepared to enter trades as advanced apprentices. Some will be taught farming, some gardening, and all, that labor is ennobling. The discipline is firm yet kind, and each boy has some one interested in him individually. There are no walls about the farm; everything is free and open. Though established less than three years ago there are already good results to be seen. Fifty-two boys have been at the farm, and of those more than twenty have, after a training of a year or more, been sent back to their parents or to places found for them, cured of bad tendencies.

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Communications will be welcomed from any quarter. Abstracts of scientific papers are solicited, and twenty copies of the issue containing such will be mailed the author on request in advance. Rejected manuscripts will be returned to the authors only when the requisite amount of postage accompanies the manuscript. Whatever is intended for insertion must be authenticated by the name and address of the writer; not necessarily for publication, but as a guaranty of good faith. We do not hold ourselves responsible for any view or opinions expressed in the communications of our correspondents.

Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

VOL. XV. NEW YORK, JANUARY 10, 1890. No. 362

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BOOK-REVIEWS.

Justice and Jurisprudence: an Inquiry concerning the Constitutional Limitations of the Thirteenth, Fourteenth, and Fifteenth Amendments. Philadelphia, Lippincott. 8°. \$3.

THIS book disarms criticism by its purpose. It is an appeal by "The Brotherhood of Liberty" in behalf of the lost civil rights of the colored people in the United States. Equal civil rights were supposed to have been legally conferred upon our colored citizens by the amendments to the Constitution after the war, especially the fourteenth, and by Senator Sumner's famous "civil rights bill," approved March 1, 1875. Shortly after the war there followed a general acquiescence, and many decisions by the minor courts, and many statutes in the several States, practically enforcing, as far as laws could do it, the equal civil rights of all citizens, without regard "to color or previous condition of servitude."

The way these rights were lost, as far as their legal guaranties are concerned, is soon told after they reached that "grave of liberty," the Supreme Court of the United States. The main points are these: The Constitution of Louisiana after the war provided that "all persons shall enjoy equal rights and privileges upon any conveyance of a public character." A law was passed by that State accordingly, similar to Senator Sumner's civil rights bill, making it a fineable offence to exclude a colored person, for that reason, from public accommodations. Mrs. De Cuir (colored) was thus excluded from the white ladies' cabin of a steamboat, and re-

covered a judgment for \$1,000, fine, therefor. The State courts affirmed that judgment. But when the case came before the Supreme Court of the United States it was reversed — and reversed on a ground that has never ceased to be a surprise; to wit, that the law was "a regulation of interstate commerce, and, therefore, to that extent, unconstitutional and void" (*Hall v. De Cuir*, 95 U. S. Repts., 485, 1877). For the United States only have jurisdiction over such commerce, and the States cannot regulate it.

The colored people and their friends were astounded at this decision. They insisted that the State Constitution and laws thus stricken down as void had nothing to do with commerce or property, but were confined to acts in regard to persons and their rights and protection. The two matters are disparate, like trying to measure legal rights by pounds or miles. Like, for instance, the demands upon Gov. Seward to return fugitive slaves because they had carried off the calico on their backs.

But there is no appeal — but to the people — from a decision of the Supreme Court, and so it was legally settled that a State could practically do nothing to enforce the equal rights and privileges of colored citizens, because commerce was king, and had to go on just as it used to do when the Dred Scott decision was in force.

Still it was hoped that the United States courts would sustain the United States civil rights law, and thus enable the general government to do what the States could not, — protect all citizens in their equal rights and privileges in public assemblies and conveyances. Five cases arising under this United States civil rights law came before the United States Supreme Court and were decided together in 1883. The court held that the Fourteenth Amendment "is prohibitory upon the States only," and does not authorize any direct legislation, "but only a correction" of State legislation; "such as may be necessary and proper for counteracting and redressing the effect of State laws or acts." Therefore the United States civil rights laws were declared unconstitutional and void. (*The civil rights cases*, U. S. R., 109, 3). The colored people and their friends have never been able to adequately express their indignation over this decision. They held many meetings for that purpose, and the book before us may be regarded as their protest in good, solid, bound form. The points they make were to a large extent presented most ably and indignantly in a dissenting opinion by Mr. Associate Justice Harlan, in which he lays aside ordinary judicial reserve, to tell the majority of the court that, "The opinion in these cases proceeds, it seems to me, upon grounds entirely too narrow and artificial. I cannot resist the conclusion that the substance and spirit of the recent amendments to the Constitution have been sacrificed by a subtle and ingenious verbal criticism. . . . Constitutional provisions, adopted in the interest of liberty, and for the purpose of securing, through national legislation if need be, rights inhering in a state of freedom, and belonging to American citizenship, have been so construed as to defeat the ends the people desired to accomplish, which they attempted to accomplish, and which they supposed they had accomplished, by changes in their fundamental law" (*same case*, p. 26).

The narrow, ingenious, and subtle criticism by which the Fourteenth Amendment was defeated by this decision, is in limiting the "provisions" of the amendment, all of which Congress is authorized to enforce, to the single negative and corrective provision over the States, whereas the plain purpose and intention of the whole of the provisions were to directly secure all citizens in equal rights; and to that end, and as a necessary incident only, the States are also restricted from violating them by their own laws. The very first one of the provisions places the whole subject within the jurisdiction of the United States, and then next follows the restraint upon States from conflicting action. But the court does not even quote in its opinion the first and main sentence and provision of the amendment, and so leaves the power of Congress to be limited and applied only to the correction of the States. "Never was a conclusion more lame, impotent, and absurd!" was the outcry of the friends of liberty everywhere. Had Senator Sumner been alive, this complete overthrow of the great object of his later life would have broken his heart. Under that decision, of course, the States will not do any thing, and the United States cannot. The colored people are thus left with the empty name of

"citizen," but neither State nor nation can legally do any thing to give effective support to that proud title.

Such is the state of the law, the details of which are presented and condemned, with great variety of illustration, in the present volume. But the remedy does not seem to be presented with equal clearness. The future of the colored race in America is indeed a dark cloud. To us the only solution is the scientific one, and that is only another name for the highest morality, justice, and humanity. We have said the only appeal from the Supreme Court is to the people. To encourage such an appeal seems to be the main object and effect of this book. It is sustained by the extraordinary fact that every successful political party has had for its main purpose the reversal of the decisions of that court. The old Republican party of Jefferson came into power to reverse the decisions of the United States courts sustaining the "Alien and Sedition laws." The Democracy of Jackson came to, and did, reverse the Supreme Court decisions in favor of the United States Bank. The Republican party of Lincoln came to reverse, and did reverse, the Dred Scott and Fugitive Slave law decisions; and the Republicans with Grant, in imitation of Cromwell, actually took judges off and put others on the supreme bench, until the court reversed its own "legal tender" decisions. These are surprising instances, and they may well encourage the colored people, by such appeals as the present, to remind the people that the objects they sought to attain by the war amendments to the Constitution, as Judge Harlan declared, have been defeated by two unfortunate accidents in the Supreme Court, which it is their bounden duty to remedy. It may just now seem impossible to get a sufficient number of States to amend the amendments. But it will soon become clear that there must be some law on these subjects. The late slave States will do nothing in their present mood. Both races are thus more and more appealing to violence. The result will be that the law-abiding elements, which placed those amendments in the Constitution, must take up the work again and make them effective. Anarchy and violence cannot be tolerated in any part of our country, and the legal remedy can come only from the general government.

Then, again, we are often reminded that the problem of the happy and beneficent adjustment and co-operation of the two races cannot be solved by statutes only. Most true, but without some solid law to fall back upon, the weaker race are practically remanded to slavery, and such is their present condition. The appeal for justice should be heard, but to insure a favorable hearing, the wise, prudent, virtuous, and industrious conduct of the colored people themselves is also practically a necessary concomitant. Without that, they will not find their old friends at the North again, and of those friends they were never in greater need than now. They are certainly right in their prayer for legal protection, for some law, so plain that the Supreme Court cannot set it aside. Unless this prayer is granted, the next appeals will be more and more to violence; and with a result that recalls perhaps the darkest blot in Grecian history, which is told as follows: When the Spartans were hard pushed in war, they called out the best of their Helots to help them. The Helots responded, and were promised their liberty for their services, which, it seems, turned defeat to victory. They were ordered to repair to the temples [of justice?] to receive their emancipation. They went, with banners and garlands, but they never returned, "and," says the careful historian, "no one ever knew by what means they were severally dispatched" (*Thucydides* 4, 80). The thought that some such passage may be written about the loyal people of America, and that it may be substantially true, is not a pleasant, but a probable outlook from our present situation.

That this publication should appear anonymously is a matter to be regretted. The plain avowal of a public purpose by every American citizen is his prerogative and duty. If he is a member of the bar, it is still more a duty to relieve the country from an error of the courts affecting grave public interests, by honestly and frankly explaining the error, and indicating the remedy, as has been attempted in this article. We have entirely too much unhealthy private grumbling, and too many secret societies seeking to do covertly what no American need to be ashamed of. We believe that the colored people back of this movement would do better to give their names, and apply to Congress, by proper petition, to

have the needful amendment to the Constitution submitted to the States. That would clear the atmosphere, and bring the issue to the front.

As to style and execution of this rather pretentious work, the florid and eloquent language, with pages of interesting but remotely relevant quotations, are indications of the African exuberance of rhetoric, about which, as a matter of taste, there is no disputing. That should not conceal from any one the intense earnestness, and the real ability, it often almost hides with the flowers which were meant to adorn and attract. In the next edition we suggest that the amendments, and the two decisions mainly involved, be printed *verbatim*, so that the reader can see the issues without reference to other books, which few but lawyers have at hand.

T. B. WAKEMAN.

Thermodynamics, Heat-Motors, and Refrigerating Machines.

By DE VOLSON WOOD. New York, Wiley. 8°. \$4.

THE fact that a third edition of this work has been called for within a year of its first publication proves that Professor Wood possesses the two essential qualifications of a successful text-book maker, namely, a thorough knowledge of his subject, and the happy faculty of imparting that knowledge to others without causing a waste of energy on their part in acquiring it. As Professor Wood aptly remarks in the preface to the first edition of this work, the "giant-like processes" of Rankine and the other founders of the science "are not adapted to the wants of the average student." Of course there is no royal road to learning for the student of any branch of science, but many unnecessary obstructions have been removed from the path of learners, in recent years, by the application of scientific principles to the art of teaching; and the application of those principles to that art are well exemplified in the work under consideration. It does not attempt to bring the subject down to the comprehension of the average reader, but we think the author has met with a fair share of success in endeavoring to lead the student up, "by a more easy and uniformly graded path," to a thorough comprehension of the subject, while at the same time familiarizing him with the way by a free use of illustrations, exercises, historic references, and numerical examples.

In this revised and enlarged edition the treatment of the theoretical part of thermodynamics, including its application to the steam engine, is mainly the same as in previous ones. Additions have been made, since the first edition, on the following subjects: the vapor engine, Sterling's engine, Ericsson's hot-air engine; gas, naphtha, and ammonia engines; the steam injector and pulsometer, compressed air engines, the compressor, the steam turbine, refrigerating machines, and the combustion of fuel. There has also been added some miscellaneous matter in an addendum, besides steam, ammonia, and other tables. The ammonia tables are new, having been computed from formulas of the author.

Fuel and its Applications. E. J. MILLS and F. J. ROWAN (Vol. I of Chemical Technology, ed. by C. E. Groves and W. Thorp). Philadelphia, Blakiston. 8°. \$7.50.

THE fact that any great work must usually be the product of a growth, rather than a single effort of however great a mind, is well illustrated by the process of evolution which has produced this cyclopedia of chemical technology. Those who remember the earlier editions of "Knapp's Technology," and who can compare its bulk and its extent, to say nothing of the perfection and accuracy of the editor's work, with its latest representative, just coming out under the editorship of Messrs. Groves and Thorp, will be amazed at the enormous extent to which the development of the chemical and related industries here treated of have expanded during the generation just past. The edition of Richardson and Ronalds illustrated the progress of a few years; that of Richardson and Watts presented another step in the path of improvement and growth, and we now have a substantially new work in which the editors have endeavored to give a fair synopsis of the facts and principles of science, as applied in the chemical industries, that shall satisfy, at least to a reasonable extent, the needs of the working chemist and of the chemical engineer,—a new but most important functionary in all great works,—and to give them a reference cyclopedia of their respective arts.

We have here the first part issued, a substantially bound and closely printed volume of 800 pages, full of well chosen illustrations, devoted entirely to the subject of fuel and its applications. A very good table of contents and a remarkably good index, both of essential importance in a work of this character, make it easy to find what is wanted, and to appreciate the magnitude and value of the work performed by the editors and writers. This volume is prepared by Dr. E. J. Mills and Mr. F. J. Rowan, the latter the well known engineer. It treats of the fuels, their chemical and physical characteristics, their sources, methods of exploiting, of preparation for their various applications, and their calorific value. The apparatus and methods of use of the several classes of combustibles, including the modern fuels, the mineral oils, and the gaseous combustibles, are exhibited at length and in detail, and the forms of apparatus employed in their utilization are illustrated. The theory of heat and of the heating efficiency of combustibles is well presented, and the methods of computation of heat developed and of temperatures attained are illustrated by examples. The principles of chimney draught are considered at great length, and the prevention of smoke, — a most important subject, especially in localities compelled to submit to the use of soft coals, — is well treated.

The portions in which the heating of houses by hot water and steam, and those in which the laws of heat-transmission are studied, are perhaps the most satisfactory and valuable in the book. These are matters which have rarely been as fully, and very seldom if at all, as well treated as we here find them. The book is worth its price for this part alone. Thirty pages are devoted to the study of furnaces using solid fuels, and as many more to the use of gas as fuel, including the theory and operation of the Siemens furnace and its many relatives. The work concludes with a very valuable examination of the practical effect of fuel, and includes very extensive and most admirably arranged tables of the American as well as foreign coals, their composition, their heating power, and their practical value as shown by experiment and use under ordinary conditions of metallurgical and engineering work.

Taken as a whole, this is probably the best work on the fuels and their use and applications that has ever yet been printed, and it possesses the advantage, for American chemists and engineers, that its contents are available for use in the United States as well as in Europe; and the special fuels of America are practically as fully treated, and in as available a manner, as are those of the transatlantic countries. This volume, if it may be taken as the index of usefulness for the whole cyclopedia, indicates that we may fairly expect the work, as a whole, to become the standard work of reference on its subjects, and to remain so for many years to come. Cyclopedic works of this character have usually been found to command a very large sale in this country, — witness the wonderful sale of the *Encyclopedia Britannica*, — and this new cyclopedia, if its sale is at all proportioned to its relative value, will find a market sufficiently extensive to handsomely repay its proprietors and contributors for their most admirable and conscientious labor.

AMONG THE PUBLISHERS.

THE Open Court Publishing Company of Chicago announces an authorized translation of M. Th. Ribot's "Psychology of Attention."

— Jefferson Davis's article on Andersonville, which the Confederate leader is said to have withdrawn from the *North American Review* because its editor insisted on certain changes, will appear in *Belford's Magazine*. The Belford Company will also publish Mr. Davis's "Short History of the Confederate States."

— D. Appleton & Company have ready the third edition of David A. Wells's "Recent Economic Changes;" the second edition of "The Ice Age of North America," by G. Frederick Wright; and new editions of "California of the South," by Lindley and Widney; "The Florida of To-Day," by J. W. Davidson; and of the "Handbook of American Winter Resorts."

— The various aspects of sore throat are considered in an article by Dr. J. M. Mills in the January number of *Babyhood*, which describes a new apparatus for the treatment of tonsillitis. The di-

rections for gargling may also be new to many mothers of young children. Startling facts are given in Dr. Dorning's paper on "The Administration of Opiates to Infants," which shows how prevalent this pernicious practice is. The comparative advantages and disadvantages of early music study for young children are discussed in another article, and there are useful hints for busy and anxious young mothers in the departments of "Nursery Helps and Novelties," "Nursery Problems" and "Mothers' Parliament."

— "Mr. Bryce's 'American Commonwealth' is out of print in England," writes Mr. Smalley to the *New York Tribune*. "The first edition in its three octavo volumes was of 1,500 copies, and is destined to become moderately scarce, for it is not likely to be reprinted in its complete form. Messrs. Macmillan are just bringing out a new and cheaper edition in two volumes, with the dangerous chapter by Mr. Goodnow omitted, or, at least, not fully reprinted. Mr. Oakey Hall has chosen to bring his action for libel against Mr. Bryce and not against the publishers, but no firm would wish to reprint an alleged libel while an action was pending; nor would Mr. Bryce himself care to."

— Charles H. Kerr & Co. of Chicago have published a discussion of the religious question by E. P. Powell, entitled "Liberty and Life." The author, having been brought up a Calvinist, has been led by the spirit of the age and his own investigations to renounce his early faith, and now stands, with many others who have passed through the same experience, on the ground of agnosticism. A large part of his book is occupied with criticisms of the old theology, which are not always in the best spirit, and are ill calculated to win converts. The part of the work to which we turned with most interest, however, is that in which he undertakes to tell us what the religion of the future will be; but we failed to find any thing new or satisfactory. All supernatural beliefs, he thinks, will be abandoned, and religion will consist mainly in cultivating our own characters and promoting the material interests of society. The book closes with one of those Utopian visions of what human life will be a hundred years hence, which have lately become so fashionable, but which, we take leave to say, are neither interesting nor edifying.

— We took up the Rev. William M. Campbell's "Footprints of Christ," published by Funk & Wagnalls, in the hope of finding something fresh in the author's conception of Christ's character and work; but in this we were disappointed. Mr. Campbell's views are those now held by the mass of Protestant theologians, according to which Christ is to be looked upon chiefly as a model of moral perfection, absolutely free from sin, and exhibiting all the virtues in their fulness; while the old theory of the supernatural being, or divine Logos, is hardly alluded to. From its own point of view the book is fairly good. Mr. Campbell endeavors to trace the various shades and lineaments of Christ's character, the special excellences which at different times he exhibited; and though his views are largely traditional and his method uncritical, his work is not without merit for moral instruction. We like in particular the stress he lays on the stronger and more rugged elements in the character of Jesus, which preachers are apt to underestimate, but which are really among his most prominent traits. But a perfect treatment of the subject requires a different method from that of this book.

— The announcement is made of the change of title from *Building to Architecture and Building* by that well known weekly. In making a change the desire has been to indicate more fully the character of the paper than is signified by the name of *Building*. *Building* has, especially of late years, devoted itself to the interest of architecture as a profession, and while it has made itself valuable and interesting to builders, this interest has been rather from the architectural side than otherwise. Yet the name has led many to suppose that it was being published rather as a representative of the builders than of the architects, and to overcome every possible misapprehension of this character in the future they have adopted the present title as better representing the character of the journal. Quite a change is made in the make-up. The two supplements that have heretofore been regular weekly features will be omitted, and departments substituted for them. In place of

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the trade supplement will be given the department of "Industrial Progress," which they purpose making a useful feature of future issues. Recognizing that architecture, however artistic, is not pure art, and that its practitioners cannot draw solely upon their inner consciousness for the development of their designs, but must regard the demands of their clients for the latest improvements both in structure and fittings, they propose in this department to place before their readers new and valuable inventions, materials, and appliances as they are placed on the market, together with appropriate notices of those valuable reference books, the trade catalogues, as they appear. The "building news" will also appear in a regular department, and two new departments, "Architectural Engineering" and "Sanitary Engineering," will be given careful attention.

— The first number of the third volume of *The American Journal of Psychology* (published now by Clark University at Worcester, Mass.) is now in press, and will appear in January, 1890, and succeeding numbers thereafter quarterly. The typography of the journal has been changed and improved. A new department of minor contributions has been added for briefer records of original observation and research in laboratories and elsewhere, and for historical chapters upon various phases of psychological science. The digests and critical reviews of European literature, which have before formed so important a feature of the journal, will be continued, and made as complete as possible. Their scope will also be enlarged so as to include, besides the fields already represented, the psychological parts of criminology and anthropology. The editorial staff will be increased, and articles of unusual value and interest are promised. The price remains five dollars per year. The first and second volumes will also be furnished unbound at five dollars per volume till further notice.

— D. Appleton & Co. will publish immediately, "Around and About South America," by Frank Vincent, who relates his experiences of twenty months, made useful with maps and plans and fifty-four full-page illustrations; "An Epitome of Herbert Spencer's Synthetic Philosophy," by F. Howard Collins, with preface by Herbert Spencer; "James G. Birney and His Times," the genesis of the Republican party, with some account of Abolition movements in the South before 1828; and "The Religion of the Semites," in which the fundamental institutions are treated by Prof. Robertson Smith, and the *International Scientific Series* will receive a new volume on "The Physiology of Bodily Exercise," by Fernand Lagrange.

— Ginn & Company have just issued "An Elementary Treatise on the Method of Least Squares," by George C. Comstock, professor of astronomy in the University of Wisconsin and director of the Washburn Observatory. This treatise has grown out of attempts by the author to so present the subject to students that a working knowledge based upon an appreciation of its principles might be acquired with a moderate expenditure of time and labor. Believing that the ultimate warrant for the legitimacy of the method is to be found in the agreement between the observed distribution of residuals and the distribution represented by the error curve, Professor Comstock has abandoned altogether the analytical demonstrations of the equation of that curve, and presents it as an empirical formula, representing the generalized experience of observers. The evidence in support of a formula of this kind is cumulative, the few curves presented in illustration being considered as samples of the kind of evidence existing. Prominence is given to the distinction between accidental and systematic errors, and the limitations which result from the difference between these two classes of errors is insisted upon.

— *The Ophthalmic Review* begins its new volume with an American editor, Dr. Edward Jackson of Philadelphia, who succeeds Dr. James Anderson of London. It will hereafter contain original articles from American as well as English ophthalmic surgeons; with notices of all ophthalmological papers published here or abroad, and full reviews of the more important of them. The *Review* is now edited by J. B. Lawford, M.D., London; Karl Grossman, Liverpool; Priestley Smith, Birmingham; John B. Story, M.D., Dublin, and Edward Jackson, M.D., 215 South Seventeenth Street, Philadelphia, to whom all American communications

concerning editorial matters, copies of papers, books for review, etc., should be addressed. The *Review* has hitherto devoted its space almost entirely to English and foreign contributions. Its success in this field has led the editors and publishers to increase its scope by including an index of American articles on ophthalmological subjects, reviews of the most important papers, original articles by well-known men, and reports of the meetings of the American Ophthalmological Society, and the section on ophthalmology of the American Medical Association.

— Gebbie & Co., Philadelphia, have just published a book on the drama, entitled "Players and Playwrights I Have Known: a record of the English stage from 1840 to 1880," by John Coleman.

— Funk & Wagnalls, have published "The Patience of Hope and Other Sermons, by the late Rev. Joseph H. Wright, with a brief Sketch of his Life," edited by Oliver J. Thatcher, Professor in the United Presbyterian Theological Seminary, Allegheny, Pa.

— The first number of *Kate Field's Washington* has made its appearance. It is a "national independent review," will be published every Wednesday, at Washington, and partakes largely of the individuality of its talented editor. Four dollars per year, ten cents per copy.

— The Belford Co. have in preparation "A New Encyclopædia of American Biography," intended to not merely cover the ground usually occupied by such publications, but to make special mention of the men and women who are doing the work and forming the thought of our own time. Mr. James R. Gilmore ("Edmund Kirke") is the editor.

— Mr. Justin Winsor is engaged upon a biographical and historical work to be entitled "Christopher Columbus: an examination of the historical and geographical conditions under which the Western Continent was disclosed to Europe, with an inquiry into the personal history of Cristoval Colon." Houghton, Mifflin & Co. will be the publishers.

— Dr. J. E. Oliver, of Boston, well known as a careful and intelligent student of American history, has edited, says the *Boston Transcript*, "the diary of William Pynchon, of Salem, and his book will be published at an early day. This diary was written during the middle and later years of the eighteenth century, and gives an accurate picture of Salem's social and political life in that interesting period. It will be issued by the Riverside Press."

LETTERS TO THE EDITOR.

* * * Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

The editor will be glad to publish any queries consonant with the character of the journal.

On request, twenty copies of the number containing his communication will be furnished free to any correspondent.

What Dr. Flint has to Say about the Nicaragua Footprints.¹

IN replying to Dr. D. G. Brinton's article of Nov. 18, 1887, issued by the American Philosophical Society, and republished in 1888 (No. 86) by the Philosophical Society of London, I entirely overlooked Dr. Brinton's quotations of Pablo Levy as authoritative for geological reference. I desire to correct the erroneous impressions caused by Levy's geological idiosyncrasies.

The volcanic convulsions that modelled the existing features of Nicaragua were acting in remote times only, in its south-western part. The lakes occupying the old craters give no indications of disturbance, while those of historical times have not changed the contour of their surface, except in small effusions of lava. The largest volcanoes are between Nindirí and Managua. The ash-eruptions of Cosequina, on the north-western confines of Nicaragua, have diminished in volume, and may be considered as extinct. Monotombo, on the north-western shore of Lake Managua, has had various ash-eruptions, but its contour remains about the same as when visited by the early Spaniards. Omotepe still keeps its cone-like contour. The last eruption in 1883 was not accompanied by trembling. Lava was thrown out near the old crater on the

¹ Extracts from a letter of Dr. Earl Flint of Revas, Nicaragua, to Hilborne T. Cresson of Philadelphia.

eastern slope, doing but little damage, however, as it was some distance from the town on that side. The ashes injured the crops on the eastern slope, and also those about Rivas. Smoke continued about three years in interrupted emissions, with violent rumbling, but no trembling of the earth. Like Monotombo, it is out of the axial line of the older and extinct volcanoes which lie between them and the primitive Cordilleras. If a line be drawn from Omotepe to Tipitapa, and thence to Cosequina, including Monotombo, the volcanic region of this district, in remote and recent times, is included within it.

This volcanic district referred to was the first occupied by early man, and even at the present time it is the most thickly populated. Strange to say, those who have written about this portion of Nicaragua, either in a historical or scientific sense, have entirely ignored it. Especially is this true in regard to its geology. Knowing this to be true, I requested Mr. I. Crawford, who is in the employ of the government, to give me his views in regard to the geological formation of this state. His remarks upon the subject are as follows.

"Geology, in the larger part of Nicaragua, promises many interesting and valuable revelations to scientists searching for evidences of time and life. It is generally supposed by the world at large, that Nicaraguans are rocked to sleep by earthquakes, but you know that this is a mistake. So far, I have not been obliged to tread in the footprints of scientific predecessors. The geology and mineralogy of this region has never been studied before. Organic matter in this country is not a kind of infusoria from active and extinct volcanoes; neither has all the organic matter in Nicaragua been incubated in the yet warm craters of extinct, nor singed by hot eruptions from active, volcanoes. Having been ordered by the commissioners of Granada to make a typical collection for exhibition at Paris, I was obliged to hurry over the mountains and ravines of this country in order to accomplish the work in time for shipment to France. The collection of geological and mineralogical specimens that I formed demonstrates that Nicaragua is not the volcanic region that Spanish gold-hunting and Indian-murdering priests declared it to be. This mistake has been copied so frequently by careless investigators that at present it passes unquestioned by our great European and American scientific associations. It is well known, that, so far, there never has been even a superficial examination of the geology and mineralogy of the region we speak of. Levy's history of Nicaragua contains so many evidences of its unreliability, that any person upon reading it is impressed at once with the fact that Levy is not relating what he saw, or obtained from reliable sources, in regard to the geology of this country: he is simply drawing upon his imagination. What a sad example for members of scientific associations who hurry into print, copying and publishing as facts things that they have not investigated, thus perplexing hardworking searchers for truth. I quote here the following paragraphs from one of my recent reports to the government of Nicaragua. 'On account of diversity in the geological formations, and for the sake of easy reference, I divide this country (Nicaragua) into three parts, called eastern, central, and western. The eastern is bounded on its south-western part as follows; commencing at 87° west longitude, from Greenwich, and 30° 30' north latitude, and extending by an irregular line to 85° 50' west longitude, and 12° 45' north latitude, thence to 85° 9' west longitude, and 11° north latitude. The geological formation of the eastern division in the northern part is composed of eozoic and lower Silurian rocks, minerals, and metals; some merely horizontal, others at various angles of inclination. The Silurian, which rests unconformably on the eozoic, is in places covered by alluvium formations. The middle and south-western parts of this eastern division are eozoic-Silurian and in some cases Devonian, each of the eras, in various places, well defined, but in that undisturbed condition in which the primitive upheaval and subsequent contractions left them, resting at various angles of inclination. No evidence of earthquakes, no volcanoes, no volcanic craters, are to be found in any part of this eastern division.' We call particular attention to this fact, and have been so much occupied by field work, in the mountains and ravines, that it has been impossible to publish a detailed account of it. The specimens collected will, however, keep fresh and tell the true story. In reference to glacia-

tion, and moraines deposited by the glaciers, I found on the mesas near Metapa, at Totumbli, rocks and moraines deposited by the glaciers, and traced them toward the Pacific Ocean.

"North-eastward for about 7 leagues there is an elevated plain adjoining that part of the valley of Sebaco, in which, at the Rio Viejo, I found a large deposit of petrified bones of quaternary and tertiary animals. In my necessarily hurried examination of the deposit where the bones were found, I recognized no bones of the human body, but several bones of parts of the head.¹ There were also a few teeth of large marsupials. These unexpected discoveries in this hitherto supposed hotbed for volcanoes I have not yet carefully examined, but hope that time will soon be given for its future study. Particular attention is called to these peculiarities in the geological formation of this part of Nicaragua, which are not in harmony with, but opposed to, statements and maps of all historians about the geology and mineralogy of Nicaragua. I was too much hurried in my examinations to satisfy myself as to whether the bones were older, or were deposited, or which were the older formation, they or the glacier. The nearest moraines and glacier-marked rocks that I noticed were about two leagues distant, 200 feet higher than where the bones are. The glacier rocks may have been strewn over the valley on a surface deposit of 200 feet directly over the bones, or, as the valley was — I have some reason to believe — once much deeper than at present, most probably the moraines and glacier-marked rocks falling in the valley were washed down the Rio Viejo by large floods into the present Lake Managua, and therefore the deposit of bones would have been made subsequent to the glacier period."

A word about the glacial period and its relation to the fossil remains mentioned in the extracts of parts of Mr. Crawford's letter as occurring in the cuttings of the Rio Viejo and the great plain of Sebaco, emptying into Lake Managua, and his uncertainty about them. As they occur some 200 feet lower than the moraines to the north-east, requiring another visit to arrive at the truth, we must say that those on the large stretches of lowland, north of Lake Nicaragua, occur under like circumstances. These plains extend back to the base of the old Cordilleras. Their upper surface is composed of black alluvium lying along the northern boulders, which were the make-up of an inland sea, or ocean inlet, shut in by the upheaval, after which the waters flowed back to the foothills, from, or due to, an accumulation of rainfalls washing down the alluvium. On the plain mentioned, north of the lake, were found the bones of what Professor Baird said belonged to *Elephas primogenitus*; while in the river banks to the east, formed of conglomerate detritus, stratified, and volcanic material (shown by pebbles of scoria, worn smooth), laborers, while excavating there in 1874, encountered a fossil human skeleton, some twenty feet below the surface.

Clear demarcations of geological epochs are found in this locality; and the question of ice age here will be decided in the near future so clearly that scientists will feel satisfied. It may be interesting also to mention, that, in 1863, while passing from Tipitapa to Talolinga, I noticed glacial deposits; also, on a hill back of San Carlos, sharp fragments of quartz rock of large dimensions are of glacial deposition. I called the attention of Professors Henry and Baird to these facts years ago, and requested the geologist of the first canal survey to visit the localities named, but he could not do so on account of press of work. In a letter to the *American Anti-quarian* I asserted that the fossils mentioned were above the clay formation,² under the ash-eruption that covered the vegetation, whose fossil leaves may determine the geological period of Nicaragua, or the time of its disappearance. The coincidence of the fossil leaves with those in the sedimentary rocks formed here after the uplifted coast range, produced by the cataclysm, goes to show that the glacial age here was disappearing. Near by, to the north-east, the glaciers crowded on towards the fierce fires from the summits of the old Cordilleras, trying to assert a supremacy in that conflict of elements, both vying in their work of desolation. The eternal

¹ A distinction between the bones of the human body and head is evidently here intended by Mr. Crawford and Dr. Flint. — H. T. Cresson.

² The ash-eruption did not extend north of the lakes to where the bones occur. It was an epoch of repose, of long duration, during which the accumulation of alluvium was deposited around the lakes and over the glacial deposits in the location mentioned.

hills, supporting them, were unmoved; ashes and ejected scorice were spread upon their declivities, and thus, aided by subsequent rains and a tropical sun, has unburied the hidden bones of various animals in the water-ways. While those of the mastodon are also exhumed, their compeers of Siberia await for a distant future to regain a tropical sun. Which of the two is the older? That any lived after the disappearance here of the glaciers, proves nothing. With proper surroundings, they might exist to-day.

I desire to state clearly that the Rev. Stephen D. Peet's assertion that Dr. Brinton makes out on my own testimony that the foot-prints did not belong to eocene times, is in error, and needlessly so, as he had received from me an explicit denial of any connection of sand with the shells. The leaves, or dust of leaves, if any were with the shells, came from trees growing around the lake. No volcanic force has disturbed the location, at least in historic times. The sandal, or some covering to protect the feet, the Rev. Mr. Peet knew was ascribed to an impression sent to Harvard, from a location forty miles distant from those at the quarry, to the south-west, and on the other side, of the range of extinct volcanoes.

I never said that the "molten streams of lava found their way into Lake Managua." There is nothing of the kind found there on the lake border. Layers of tufa, made up of volcanic detritus, is the formation of all the district we speak of; and at Masaya, Juotepi, etc., the Tiscapa lava flow spoken of by Levy must have occurred to that gentleman in his dreams. If Dr. Brinton had not quoted Levy in connection with my attempt to explain the history of the impressions I sent him, no such erroneous data would have gone forth in regard to the outbursts of lava that occurred. The mountain of Masaya, between Nindri and Managua, is the only notable locality. It passed over the old tufa. Monobrachio also ejected lava, and it spread over the plain to the south-west of Granada. These mountains were in action long subsequent to those mentioned.

The Rev. Mr. Peet's assertion that Harvard and the National Museum have only slabs with impressions of feet to judge from, is also incorrect. If he will re-peruse his own *Antiquarian*, he will find there bitter complaints, on my part, in regard to the lack of care in the examination of fossils found with and separate from them, which alone would identify their geological age. His aim is undoubtedly to keep up the controversy. Truth is certainly not obtained by making direct denials of phenomenal occurrences that Dr. Brinton and Mr. Peet never saw or investigated. The "big-toe" argument will not apply to an arched instep. A long *os calcis* and a flat-footed race have the big toe perfect. Let us wait until one of the fossil feet are found. Before belittling finds of the class mentioned they should be compared with similar ones occurring under volcanic formations in other countries whose geological examination has been determined by competent men. "The great volcanic outburst that overran northern and central California," says Dr. L. G. Yates of Santa Barbara, "covered the relics of a race who were there, and lived there, previously, whose implements were found under Table Mountain, a basaltic formation, two hundred feet in thickness. These relics are unique, and were made, and covered by lava, so long ago, that the river bed down which the lava ran (and where it still lies, forming the summit) is now high above the surrounding country, forming the Table Mountain, and where the mountains which were on either side of the old river-bed have been washed away, and their places now occupied by valleys and river-beds, and since which time the whole surface of the country has been changed, with a new surface soil, a new vegetation, and a new fauna."

Facts of this nature, by men of Dr. Yates's character, should not be ignored. No sceptic can doubt that man existed there in as remote times as here in Central America. I have often reported that there was a resemblance in the geological finds of the two. California has no greater variety of minerals; gold, silver, tin, lead, bismuth, platinum, nickel, zinc, iron, etc., are among the metals.

I want to call the attention of scientists to this neglected spot in Nicaragua, and convince them that man existed here long prior to the glacial era. Will some of the scientists in the United States do me the favor to look over the few shells sent by me to the National Museum. These specimens will tell the exact time (geologically)

when man lived here in the caves, and subsisted on the very oysters (i.e., from the shells). The specimens may be seen among those I forwarded a few years ago, and which are now in some part of the National Museum.

Science Text-Books.

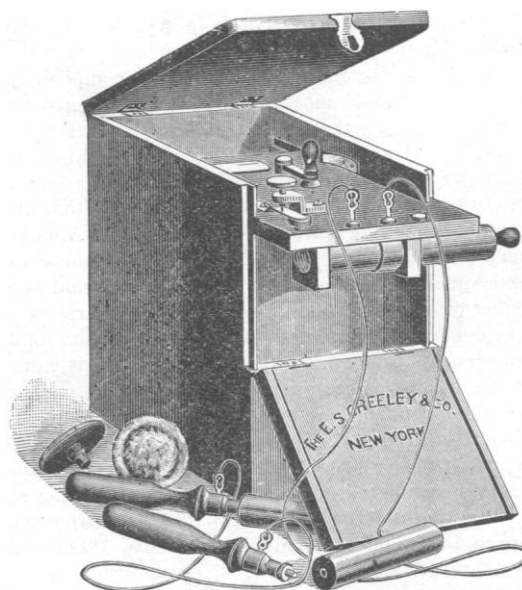
Is there to be found a really good "Physics" for lads of twelve to fifteen, as good as Shaler's "Geology" and Packard's "Zoology"? Several firms publish and manage to "introduce" a lot of old rubbish as science text-books. It is a scandal that ought to be ventilated. I have just opened a "History" sent out by a firm that professes to patronize and popularize science, and my boys are promptly told, "For the history of the Creation, Deluge, and Dispersion, the reader is referred to the Scriptural narrative." It needs some patience to get through this *Aufklavung* from stuff to real science.

P.

INDUSTRIAL NOTES.

New Electro-Medical Apparatus.

AN improved form of Laclanche Faradic battery for the use of physicians and surgeons, is shown in the accompanying illustration. In this battery the exciting fluid is a simple and inexpensive solution of sal ammoniac and water, which will last without renewal from six to twelve months. The zinc element is a pencil of pure metal, the position of which is never disturbed, whether the battery is in action or not. It usually lasts over a year, and is re-



placed at slight expense. The carbon element does not require renewal, as a rule, oftener than once in two years.

The battery has a handsomely polished hard-wood case, opening at the top and at the front. It is provided with a metallic handle, which, together with all the metallic parts of the machine itself, is nickel-plated. The case measures nine and a quarter inches high, five inches and a half wide, and seven inches and a half long. In the case is a commodious electrode pocket containing a pair of interchangeable electrode handles, a pair of nickel-plated hand electrodes, and a sponge electrode. The battery cell is inclosed in an inner compartment, which, while it is closed up and completely separates the cell from the rest of the apparatus, is arranged with a sliding cover to give convenient access to it whenever required.

A feature of special importance is the fact that the cell and all its working parts are mounted on a polished ebonized slide, with automatic electrical contacts beneath its surface. The act of pulling out this slide a short distance serves to start the machine, and closing it up cuts out the cell and stops the action. This makes it impossible to close the case without cutting out the cell. This battery is manufactured by E. S. Greeley & Company of this city.